REMARKS

Claim Objections

Claims 5-12 and 14-31 have been objected to because of informalities regarding the redundant recitation of the following claim language"said one or more membranes being formed of fibrils." This inadvertent error has been corrected herein, and this objection may now be reconsidered and withdrawn. Such action is respectfully requested.

Claim Rejections - 35 U.S.C. §112

Claims 1-32 have been rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement, in that the claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the Inventor(s), at the time the application was filed, had possession of the claimed invention. This rejection is respectfully traversed.

The "rejected" limitation in the claims now reads as follows, "said one or more membranes being primarily formed of fibrils." Support for this limitation is taken from Pages 15 and 16 of Provisional Application No. 60/117,852, the disclosure of which was incorporated by reference in the pending specification as stated at Page 13 of the PCT Publication – WO 00/44485. Copies of these pages are attached for the convenience of the Examiner.

As taught in the cited Provisional Application, "Figures 7 and 8 show the inner surfaces respecetively of a fiber of Example 1, Sample #8. The inner surface is made up

of fiber-like structures in a whorl-like pattern, and the outer surface is primarily made up of oriented fiber-like structures." These "fiber-like structures" are called fibrils herein, consistent with the dictionary definition of the term. Support for the amended claim language is clearly provided by the application incorporated by reference, and the Section 112 rejection should be reconsidered and withdrawn. Such action is respectfully requested.

Claim Rejections - 35 U.S.C. §102

Claims 1-6, 8-18, 20-24, 26-30 and 32 are rejected under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Kawai et al (US 5,168,680). This rejection is respecfully traversed.

The '680 patent claims a membrane that is "substantially' devoid of a fibrillated portion. As stated in Claim 1, the invention of the '680 patent is:

> A porous film membrane consisting essentially of a layer of a porous polytetrafluoroethylene resin particle bond structure substantially devoid of a fibrillated portion.

The '680 patent otherwise does not make any other explicit reference to the fibril content of the membranes formed therein. A search of the specification for the term fibril or the like, found nothing. At best, the '680 patent teaches what it claims - a membrane formed with only a "minor" fibril content, not a membrane "primarily" made up of fibrils, as recited in the amended claims. Clearly the '680 patent does not anticipate the amended claims. Accordingly, the Section 102(b) rejection should be reconsidered and withdrawn. Such action is respectfully requested.

Claim Rejections - 35 U.S.C. §103

Claims 7,19,25,31 are rejected under 35 U.S.C. §103(s) as being unpatentable over Kawai ('680) in view of EP 0175432A2. This rejection is respectfully traversed.

The primary reference has been distinguished above. The '680 patent neither teaches nor suggests all the elements of the amended claims. The additional teachings provided by the cited EPO Publication do not overcome the deficiencies of the teachings of the '680 patent. At best, the proposed combination of these references would only yield a substantially fibril-free membrane including the alkyl group and the fabric reinforcement for the flat sheet membrane as taught in the EPO Publication. That combined teaching is not the invention claimed herein. Accordingly, the Section 103(a) rejection should be reconsidered and withdrawn. Such action is respectfully requested.

EXTENSION OF TIME

Applicant hereby petitions for a one-month extension of time in connection with the filing of this response. The initial three-month response deadline expired on April 5, 2004. The extended filing deadline expires on May 5, 2004.

FEE AUTHORIZATION

Please charge all fees (excess claim fees, time extension fees) associated with this filing to our Deposit Account – No. 19-0733.

CERTIFICATE OF FACSIMILE TRANSMISSION

The undersigned hereby certifies that this correspondence was submitted by facsimile in the USPTO on the date shown on Page 1.

Respectfully submitted,

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Document No. 99304

sandwich may extend a short length pass the end of the housing or may be of equal length as the housing. A similar process is then conducted at the other end of the housing/pleated membrane sandwich cylinder.

The sealing means and the membrane 40 are formed of one or more perfluorinated, thermoplastic resins. Preferably, each of the elements of the device is preferably formed from one or more perfluorinated thermoplastic resins.

The membrane may also be in the form of one or more hollow fibers. Perfluorinated thermoplastic hollow fibers and their method of making are taught in US Patent Applications 60/117,852 and 60/117,854, filed January 29, 1999 and US Patents 4,902,456, 4,906,377, 4,990,294, and 5,032,274, all of which are incorporated herein in their entireties.

The housing and the selection and arrangement of the membrane within the housing is a matter of design and is well known to one of ordinary skill in the art. In the usual case, a bundle of a plurality of hollow fiber membranes having two ends is fluid tightly sealed or potted in at least one end. The potted end or ends is cut perpendicularly to the fiber direction or otherwise trimmed to open the fibers for fluid flow.

Practitioners use several methods to form hollow fiber membrane cartridges. In one case, a bundle of a plurality of hollow fiber membranes would be potted with the fibers oriented more or less parallel to the housing axis and each end of the bundle potted. Either or both potted ends would be cut and opened, depending on the cartridge design and application. In other cases, the fiber bundle is made into a looped arrangement. This can be a simple folded-over single loop, or more complex cross wound type structures that are freestanding. The single loop is usually potted at the non-looped end, although some practitioners will pot the looped end for stability in use. The wound structures can be potted at one or both ends. In some cases, the wound structure is cut in half before potting to form two looped structures, each of which is potted at the cut ends.

A cartridge similar to those shown in Figures 1 and 2 could be envisioned by one skilled in the art for what is usually termed "dead end" filtration. The practitioner would substitute a potted fiber bundle for the pleated membrane filter sandwich. These could be used with either the feed stream fluid to be filtered contacting the outside surface of the membranes and the filtered fluid recovered from the lumen of the fibers, or the feed stream could be fed to the lumen of the hollow fiber membranes and the filtered fluid recovered form the outer surface of the fibers.

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April 05, 2000

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: *60/117,852*
FILING DATE: *January 29, 1999*
PCT APPLICATION NUMBER: *PCT/US00/02198*

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

N. WOODSON
Certifying Officer

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Cooling Bath

The cooling bath lowers the temperature of the extruded fiber to below the upper critical solution temperature to cause phase separation. The bath liquid can be any liquid having a boiling point high enough to prevent bubbles from forming on the fiber exiting the die, and not adversely affecting the surface pore forming process. The bath temperature can be from 25°C to 230°C, with a preferred range being 50°C to 150°C.

The bath liquid can be any liquid that does not boil at the cooling temperature, or at the point where the heated extrudate enters the cooling bath, or interact with the fiber to cause a skin to form, or to dissolve or swell the polymer at the cooling bath temperature. Examples of preferred liquids are dimethylsilicone oil and di-octyl pthalate. Other di-substituted pthalates may be used.

Extraction and Drying

The gel fiber is then introduced into a liquid extraction bath of a liquid that will remove the solvent without substantially softening, weakening, or dissolving the fiber. Suitable extraction solvents include dichlorofluorethane, HCFC-141b, 1,1,2 trichlorotrifluoroethylene (Freon® TF, DuPont), hexane or similar. Extraction is usually done at from about 20°C to about 50°C to minimize the effect of the extracting liquid on the fiber. The extracted fiber is dried under restraint to prevent shrinkage, as on a cylindrical core, at from 20°C to 50°C. Optionally, the fiber is then heat set at 200°C to 300°C.

The advantage of the submerged extrusion method is that it can produce hollow fiber membrane continuously in practical lengths. Perfluorinated thermoplastic hollow fiber membranes made by prior art methods break easily during extrusion and practical lengths cannot be collected. The membranes produced by the submerged extrusion method have high surface porosity and good permeability. Figures 5 and 6 show the inner and outer surfaces respectively for a fiber of Example 1, sample #3. The inner surface has an unskinned surface consisting of nodules. The outer surface is made up of fibrous-like oriented structures. Figures 7 and 8 show the inner and outer surfaces respectively of a fiber of Example 1, Sample # 8. The inner surface is made up of fiber-like structures in a whorl-like

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pattern, and the outer surface is primarily made up of oriented fiber-like structures. Figures 9 and 10 show the inner and outer surfaces respectively of a fiber of Example 5. Both surfaces are highly porous, with no smooth skin regions. These Figures illustrate various highly porous or skinless surfaces that can be produced in a continuous process by the submerged extrusion method . It can be appreciated that high surface porosity of the skinless membranes of the present invention will be less likely to become plugged up or fouled by particulates during a filtering operation. This will result in longer and more effective operation of the membrane.

Figure 3 illustrates a typical process for vertical spinning to produce the hollow fibers of the invention. The polymer/solvent paste-like mixture is introduced into a heated barrel extruder **31** through inlet **32**, by means of a pumping system **47**, for example, a progressive cavity pump. A solution is formed is formed in the heated barrel of extruder **31**. Extruder **31** conveys the heated solution through conduit **33** into melt pump **34** which meters the solution, and then through conduit **35** to cross head die **36**. Optionally, the solution is conveyed from extruder **31** through conduit **33** into melt pump **34**, and then through conduit **48** to solution filter **49**, and then through conduit **35** to cross head die **36**.

The solution passes through the cross head die **36** and into the die nose **1** where the solution is formed into a hollow fiber shape. The lumen fluid is introduced from die mandrel **38** to the inner diameter of the hollow fiber solution exiting from the die. The lumen fluid is supplied to die mandrel **38** by means of lumen fluid supply means **46**.

For vertical fiber spinning, the solution with lumen fluid is extruded from die nose **1** vertically with no air gap into cooling bath fluid **7** contained in cooling bath **41** where the solution is cooled to effect the microphase separation of polymer and solvent into a gel membrane hollow fiber **8**. The gel membrane hollow fiber **8** is guided through the cooling bath **41** by guide rollers **43** and is removed from the cooling bath **41** by Godet rolls **44**. The gel membrane hollow fiber **8** is removed from the Godet rolls **44** by cross winder **45**.

Figure 4 illustrates a typical process for horizontal spinning to produce the hollow fibers of the invention. The polymer/solvent paste-like mixture is introduced into a heated barrel extruder **31** through inlet **32**, by means of a pumping system **47**.

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